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Patentanmeldung Nr. | Patent application No. | Demande de brevet n°

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Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le Président de l'Office européen des brevets
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R C van Dijk

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High-pressure discharge lamp

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High-pressure discharge lamp

The invention relates to a high-pressure discharge lamp.

High-pressure discharge lamps ranging from 35 to 150 W have become a dominant player in lighting retail applications. Trends have emerged which create positive conditions for range extensions towards lower lumen packages and/or lower wattages. Lower light levels are being used, for instance in exclusive shops, focusing the light on the goods instead of flooding the area. End users in the market become more and more interested in a uniform quality of the light and would prefer to employ high-pressure discharge lamps instead of using halogen lamps for the low lumen packages and accent lighting.

Generally, high-pressure discharge lamps of the kind mentioned in the opening paragraph either have a discharge vessel with a ceramic wall or have a quartz glass discharge vessel. Such high-pressure discharge lamps are widely used in practice and combine a high luminous efficacy with favorable color properties. The discharge vessel of the lamp contains one or several metal halides in addition to Hg and a rare gas filling.

A ceramic wall in the present description and claims is understood to be a wall made from one of the following materials: monocrystalline metal oxide (for example sapphire), densely sintered polycrystalline metal oxide (for example Al_2O_3, YAG), and densely sintered polycrystalline metal nitride (for example AlN).

A lamp of the kind mentioned in the opening paragraph is known from US Patent US-A 4 888 517. The known discharge lamp is a double-enveloped lamp having a shield surrounding a light-source capsule within a thick-walled outer envelope so that the lamp may be safely operated without necessity of a protective fixture. In the rare event of a burst of the light-source capsule, the shield absorbs and dissipates a portion of the burst energy sufficient to permit the thick-walled outer envelope to remain intact and contain shards and other internal parts within the lamp.

A disadvantage of the known high-pressure discharge lamp is that a shield is necessary in order to safely operate the discharge lamp. This shield makes the lamp relatively large in size.

The invention has for its object to eliminate the above disadvantage wholly or partly. According to the invention, a high-pressure discharge lamp of the kind mentioned in the opening paragraph for this purpose comprises:

an outer envelope in which a discharge vessel is arranged around a longitudinal axis,

the discharge vessel enclosing, in a gastight manner, a discharge space provided with an ionizable filling,

the discharge vessel having a first and a second mutually opposed neck-shaped portion through which a first and a second current-supply conductor, respectively, extend to a pair of electrodes arranged in the discharge space,

the outer envelope having a bulb-shaped portion adjacent the discharge space,

the bulb-shaped portion having a wall thickness d_1,

the remainder of the outer envelope having a wall thickness d_2,

the ratio of d_1 and d_2 being in the range:

$$0.35 \leq \frac{d_1}{d_2} \leq 1.5.$$

By providing an outer envelope with a bulb-shaped portion with a wall thickness in the range according to the invention, the bulb-shaped portion of the outer envelope has a relative wall thickness which is larger than the relative wall thickness of the bulb-shaped portion in the known discharge lamp. In the known discharge lamp, the envelope is formed by blow-molding the hard glass envelope. In the known discharge lamp the wall thickness is not uniform. In particular, the bulb-shaped portion of the outer envelope of the known discharge lamp has a minimum wall thickness. During the blow-molding process, the glass is blown into the bulbous shape. As the wall is stretched into the bulb shape, the wall thickness is reduced accordingly in proportion to the degree of stretching. Hence, in the known discharge lamp, the wall has been stretched to the greatest degree in the vicinity of the discharge space. The wall thickness of the outer envelope of the known

discharge lamp is at a minimum adjacent the discharge space in the discharge vessel. This makes the outer envelope sensitive to bursts and a protective shield or sleeve is necessary to ensure the necessary protection in the event explosion phenomena occur in the discharge vessel. In the known discharge lamp the shield or sleeve absorbs and dissipates a portion of the burst energy sufficient to permit the outer envelope to remain intact and contain shards and other internal parts within the lamp.

Depending on the form of the bulb-shaped portions the wall thickness of the known bulb-shaped portion is approximately 30% of the wall thickness of the remainder of the outer envelope. By thickening the wall thickness of the bulb-shaped portion as compared to the wall thickness of the remainder of the outer envelope ($d_1/d_2 \geq 0.35$), the bulb-shaped portion according to the invention is in itself capable of absorbing and dissipating a portion of the burst energy. In case, the wall thickness of the outer envelope is uniform also in the bulb-shaped portion, the ratio of the wall thickness of the bulb-shaped portion as compared to that of the remainder of the outer envelope is $d_1/d_2 \approx 1$. In case $d_1/d_2 \approx 1.5$, the wall thickness of the bulb-shaped portion is larger than the wall thickness of the remainder of the outer envelope giving additional strength to the bulb-shaped portion.

In the high-pressure discharge lamp according to the invention, the need for a shield or sleeve containing a burst of the discharge vessel is diminished. Not incorporating the shield or sleeve simplifies the manufacture of the discharge lamp, lowers the costs of the discharge lamp and improves the visual attractiveness of the discharge lamp. In addition, the discharge lamp according has relatively small dimensions.

Preferably, the ratio of d_1 and d_2 is in the range:

$$0.4 \leq \frac{d_1}{d_2} \leq 0.8.$$

In this range, a shield or sleeve in the high-pressure discharge lamp can be safely avoided with.

A preferred embodiment of the high-pressure discharge lamp according to the invention is characterized in that the bulb-shaped portion of the outer envelope is formed in a mould holder. Forming the bulb-shaped portion in a mould holder enables the realization of a wall thickness of the bulb-shaped portion as compared to the wall thickness of the remainder of the outer envelope, such that wall thickness is less reduced than according to the

stretching into the bulb shape of the bulb-shaped portion as is the case in the known discharge lamp.

Preferably, the outer envelope is made from quartz glass, hard glass or soft glass. Preferably, the discharge vessel has a quartz wall or a ceramic wall.

A preferred embodiment of the high-pressure discharge lamp according to the invention is characterized in that the ratio between the distance d_e between the electrodes and the height h_{dl} of the high-pressure discharge lamp along the longitudinal axis ranges from:

$$0.02 \leq \frac{d_e}{h_{dl}} \leq 0.2.$$

According to this embodiment of the invention, the height h_{dl} of the high-pressure discharge lamp along the longitudinal axis can be smaller than approximately 50 mm for a distance d_e between the electrodes ranging from approximately 1 mm to approximately 10 mm. The high-pressure discharge lamp according to the invention has the advantage that the discharge vessel has very compact virtual dimensions which render the lamp highly suitable for use in compact lighting applications.

The invention will now be explained in more detail with reference to a number of embodiments and a drawing, in which:

Figure 1 shows an embodiment of the high-pressure discharge lamp according to the invention, and

Figure 2 shows an alternative embodiment of the high-pressure discharge lamp according to the invention, and

Figure 3 shows a further alternative embodiment of the high-pressure discharge lamp according to the invention.

The Figures are purely diagrammatic and not drawn true to scale. Some dimensions are particularly strongly exaggerated for reasons of clarity. Equivalent components have been given the same reference numerals as much as possible in the Figures.

Figure 1 very diagrammatically shows an embodiment of a high-pressure discharge lamp according to the invention. The high-pressure discharge lamp comprises a

discharge vessel 11 arranged around a longitudinal axis 22. The discharge vessel 11 encloses, in a gastight manner, a discharge space 13 provided with an ionizable filling comprising mercury, a metal halide and a rare gas. In the example of Figure 1, the discharge vessel 11 has a first neck-shaped portion 2 and a second mutually opposed neck-shaped portion 3 through which portions a first current-supply conductor 4 and a second current-supply conductor 5, respectively, extend to a pair of two electrodes 6, 7, which electrodes 6, 7 are arranged in the discharge space 13. The high-pressure discharge lamp is further provided with a lamp base 8 made from an electrically isolative material. The lamp base 8 supports the discharge vessel 11 via the first and second current-supply conductors 4, 5. The lamp base 8 also supports the outer envelope 1. In the example of Figure 1, the lamp base 8 is provided with a first contact member 14 which is connected to the first current-supply conductor 4. In addition, the lamp base 8 is provided with a second contact member 15 connected to the second supply conductor 5 via a connection conductor 16 running alongside the discharge vessel 11.

In an alternative embodiment, instead of providing contact members, two feedthrough tubes may be provided in the lamp base, which allow the current-supply conductors to be fastened in these feedthrough tubes. The fastening in these feedthrough tubes may be done by resistance, laser welding or crimping. An advantage of the use of feedthrough tubes instead of the contact members is that more freedom of positioning the discharge vessel on the longitudinal axis of the high-pressure discharge lamp is attained. A further advantage of the use of a feed-through is the elimination of the tabulation 18, simplifying the construction of the discharge lamp and lowering the costs. This may further improve the precise positioning of the discharge vessel in the outer envelope of the high-pressure discharge lamp.

Preferably, the outer envelope 1 is connected to the lamp base 8 in a gas-tight manner. By controlling the atmosphere in the outer envelope 1, the current-supply conductors 4, 5 are well protected against oxidation. By preventing oxidation of the current-supply conductors 4, 5, the current-supply conductors 4, 5 can be positioned relatively close to the discharge vessel 11. By controlling the atmosphere is the outer envelope, press seals and/or tipped-off (quartz) tabulations can be avoided resulting in a simplified and compact high-pressure discharge lamp. Preferably, an exhaust tube 18 for evacuating the lamp bulb 1 is provided in the lamp base 8. In this manner, the outer envelope 1 can be evacuated via the exhaust tube 18 after the discharge vessel 11 and the outer envelope 1 have been mounted on the lamp base 8 of the high-pressure discharge lamp. After evacuating and, if desired,

providing the desired atmosphere inside the outer envelope, the exhaust tube 18 is sealed off. Preferably, a getter is used inside the outer envelope, for instance a zirconium/aluminum alloy, to absorbed impurities, for instance water/hydrogen and oxygen. It is advantageous if the exhaust tube 18 in the lamp base 8 is made from a metal or from a pre-oxidized NiCrFe alloy. Preferably, the exhaust tube 18 is made from NiFeCr alloy like vacovit.

Preferably, the lamp base 8 is preferably made from quartz glass, hard glass, soft glass or a ceramic material. In addition, the lamp base 8 is provided as a sintered body, preferably, a sintered ceramic body. Preferably, the lamp base 8 is in the form of a plate. The lamp base 8 can be manufactured with a high dimensional accuracy. The lamp base 8 has the additional advantage that it can be made in a light color, for example white or a pale grey. By employing a material with a light color, light emitted by the discharge vessel 11 will be reflected into usable beam angles, thereby increasing the efficiency of the luminaire or the total efficiency of the high-pressure discharge lamp. It is prevented thereby that the light incident on the lamp base 8 is lost to the light beam, which may be formed by means of a reflector. In addition, it is favorable when the lamp base 8 has a (flat) plane at its surface facing away from the discharge vessel 11. This surface may be mounted against a (lamp) holder, for example a carrier, for instance a reflector, and accordingly is a suitable surface for serving as a reference for the position of the discharge vessel 11. In another favorable embodiment, the surface of the lamp base 8 facing the discharge vessel has a central elevation, which serves to center the discharge vessel 11 and enamel ring with respect to the lamp base 8 during the manufacture of the high-pressure discharge lamp.

Preferably, the outer envelope 1 is made from quartz glass, hard glass or soft glass. The outer envelope 1 is, preferably, fastened to the lamp base 8 by means of an enamel of (glass) frit. It is favorable when the enamel is provided in the form of a previously shaped ring. Using such a previously shaped ring largely improves the accuracy of the positioning of the discharge vessel 11 during the manufacture of the high-pressure discharge lamp. The choice of the enamel depends on the material of the outer envelope 1 and on the material of the lamp base 8.

According to the invention part of the outer envelope 1 in Figure 1 is provided with a bulb-shaped portion 2 adjacent the discharge space 13. In Figure 1 the bulb-shaped portion 2 is shaped in a substantially spherical form and has a wall thickness d_1. In Figure 2, the remainder of the outer envelope (1) has a wall thickness d_2. The ratio of the respective wall thickness d_1 and d_2 is in the range:

$$0.35 \leq \frac{d_1}{d_2} \leq 1.5.$$

By providing an outer envelope with a bulb-shaped portion with a wall thickness in the range according to the invention, the bulb-shaped portion of the outer envelope has a relative wall thickness which is larger than the relative wall thickness of the bulb-shaped portion in the known discharge lamp. In the known discharge lamp the wall thickness is not uniform. In particular, the bulb-shaped portion of the outer envelope of the known discharge lamp has a minimum wall thickness. This makes the outer envelope sensitive to bursts and a protective shield or sleeve is necessary to ensure the necessary protection in the event explosion phenomena occur in the discharge vessel. In the known discharge lamp the shield or sleeve absorbs and dissipates a portion of the burst energy sufficient to permit the outer envelope to remain intact and contain shards and other internal parts within the lamp.

Depending on the form of the bulb-shaped portion the wall thickness of the bulb-shaped portion of known discharge lamps is approximately 30% of the wall thickness of the remainder of the outer envelope. In other words, $d_1/d_2 \approx 0.3$. By, according to the invention, thickening the wall thickness of the bulb-shaped portion as compared to the wall thickness of the remainder of the outer envelope ($d_1/d_2 \geq 0.35$), the bulb-shaped portion is in itself capable of absorbing and dissipating a portion of the burst energy. In case, the wall thickness of the outer envelope is uniform also in the bulb-shaped portion, the ratio of the wall thickness of the bulb-shaped portion as compared to that of the remainder of the outer envelope is $d_1/d_2 \approx 1$. In case $d_1/d_2 \approx 1.5$, the wall thickness of the bulb-shaped portion is larger than the wall thickness of the remainder of the outer envelope giving additional strength to the bulb-shaped portion.

In the high-pressure discharge lamp according to the invention, the need for a shield or sleeve containing a burst of the discharge vessel is diminished. Not incorporating the shield or sleeve simplifies the manufacture of the discharge lamp, lowers the costs of the discharge lamp and improves the visual attractiveness of the discharge lamp. In addition, the discharge lamp according has relatively small dimensions.

Preferably, the ratio of d_1 and d_2 is in the range:

$$0.4 \leq \frac{d_1}{d_2} \leq 0.8.$$

In this range, a shield or sleeve in the high-pressure discharge lamp can be safely avoided with. In a favorable embodiment of the high-pressure discharge lamp according to the invention, the ratio $d_1/d_2 \approx 0.5$.

In Figure 2 schematically shows an alternative embodiment of the high-pressure discharge lamp according to the invention. In this embodiment, the exhaust tube 18 also forms a feed through tube to which the current-supply conductor 4 is fastened.

Figure 3 schematically shows a further alternative embodiment of the high-pressure discharge lamp according to the invention. In the example of Figure 3, a so-called double-ended embodiment of the high-pressure discharge lamp is shown. Two lamp bases 8, 8' are provided between a substantially cylindrical outer envelope 1. The exhaust tube 18 is, preferably, provided only in one of the lamp bases 8.

By controlling the atmosphere in the outer envelope, a simplified and compact high-pressure discharge lamp can be made. In particular, the length of the high-pressure discharge lamp can be significantly reduced. To this end a preferred embodiment of the high-pressure discharge lamp is characterized in that the ratio between the distance d_e between the electrodes and the height h_{dl} of the high-pressure discharge lamp along the longitudinal axis ranges from:

$$0.02 \leq \frac{d_e}{h_{dl}} \leq 0.2$$

According to the invention, a simplified lamp design is provided which can be used as a building block for a family of products based on a modular capsule lamp. The discharge vessel 11 is supported on the current-supply conductors 4, 5 that are fixedly connected to the base plate 8. The discharge vessel 11 as well as the current-supply conductors 4, 5 are positioned in the outer envelope 1 which is kept under a controlled atmosphere. Elimination of the press seals and and/or tipped-off (quartz) tubulations results in a compact high-pressure discharge lamp. Preferably, the height h_{dl} of the high-pressure discharge lamp is equal to or less than 50 mm, preferably less than 40 mm. In addition, positioning issues of the discharge vessel 11 are eliminated due to the more controlled manufacturing of the high-pressure discharge lamp with respect to the longitudinal axis 22 and, in addition, the discharge vessel 11 can be accurately positioned in a plane orthogonal to the longitudinal axis 22.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

CLAIMS:

1. A high-pressure discharge lamp comprising:

an outer envelope (1) in which a discharge vessel (11) is arranged around a longitudinal axis (22),

the discharge vessel (11) enclosing, in a gastight manner, a discharge space (13) provided with an ionizable filling,

the discharge vessel (11) having a first (2) and a second (3) mutually opposed neck-shaped portion through which a first (4) and a second (5) current-supply conductor, respectively, extend to a pair of electrodes (6, 7) arranged in the discharge space (13),

the outer envelope (1) having a bulb-shaped portion (2) adjacent the discharge space (13),

the bulb-shaped portion (2) having a wall thickness d_1,

the remainder of the outer envelope (1) having a wall thickness d_2,

the ratio of d_1 and d_2 being in the range:

$$0.35 \leq \frac{d_1}{d_2} \leq 1.5.$$

2. A high-pressure discharge lamp as claimed in claim 1, characterized in that the ratio of d_1 and d_2 is in the range:

$$0.4 \leq \frac{d_1}{d_2} \leq 0.8.$$

3. A high-pressure discharge lamp as claimed in claim 1 or 2, characterized in that the outer envelope (1) is made from quartz glass, hard glass or soft glass.

4. A high-pressure discharge lamp as claimed in claim 3, characterized in that the bulb-shaped portion (2) of the outer envelope (1) is formed in a mould holder.

5. A high-pressure discharge lamp as claimed in claim 1 or 2, characterized in that the discharge vessel has a quartz wall or a ceramic wall.

6. A high-pressure discharge lamp as claimed in claim 1 or 2, characterized in that the ratio between the distance d_e between the electrodes (6, 7) and the height h_{dl} of the high-pressure discharge lamp along the longitudinal axis (22) ranges from:

$$0.02 \leq \frac{d_e}{h_{dl}} \leq 0.2.$$

ABSTRACT:

The invention relates to a high-pressure discharge lamp with an outer envelope (1) in which a discharge vessel (11) is arranged around a longitudinal axis (22). The discharge vessel encloses, in a gastight manner, a discharge space (13) provided with an ionizable filling. The discharge vessel has a first (2) and a second (3) mutually opposed neck-shaped portion through which a first (4) and a second (5) current-supply conductor, respectively, extend to a pair of electrodes (6, 7) arranged in the discharge space (13). The outer envelope (1) has a bulb-shaped portion (2) adjacent the discharge space with a wall thickness d_1. The remainder of the outer envelope has a wall thickness d_2. The ratio of d_1 and d_2 is in the range:

$$0.35 \leq \frac{d_1}{d_2} \leq 1.5.$$

Preferably,

$$0.4 \leq \frac{d_1}{d_2} \leq 0.8.$$

Preferably, the bulb-shaped portion is formed in a mould holder. According to the invention a simplified and compact high-pressure discharge lamp is provided.

Fig. 1

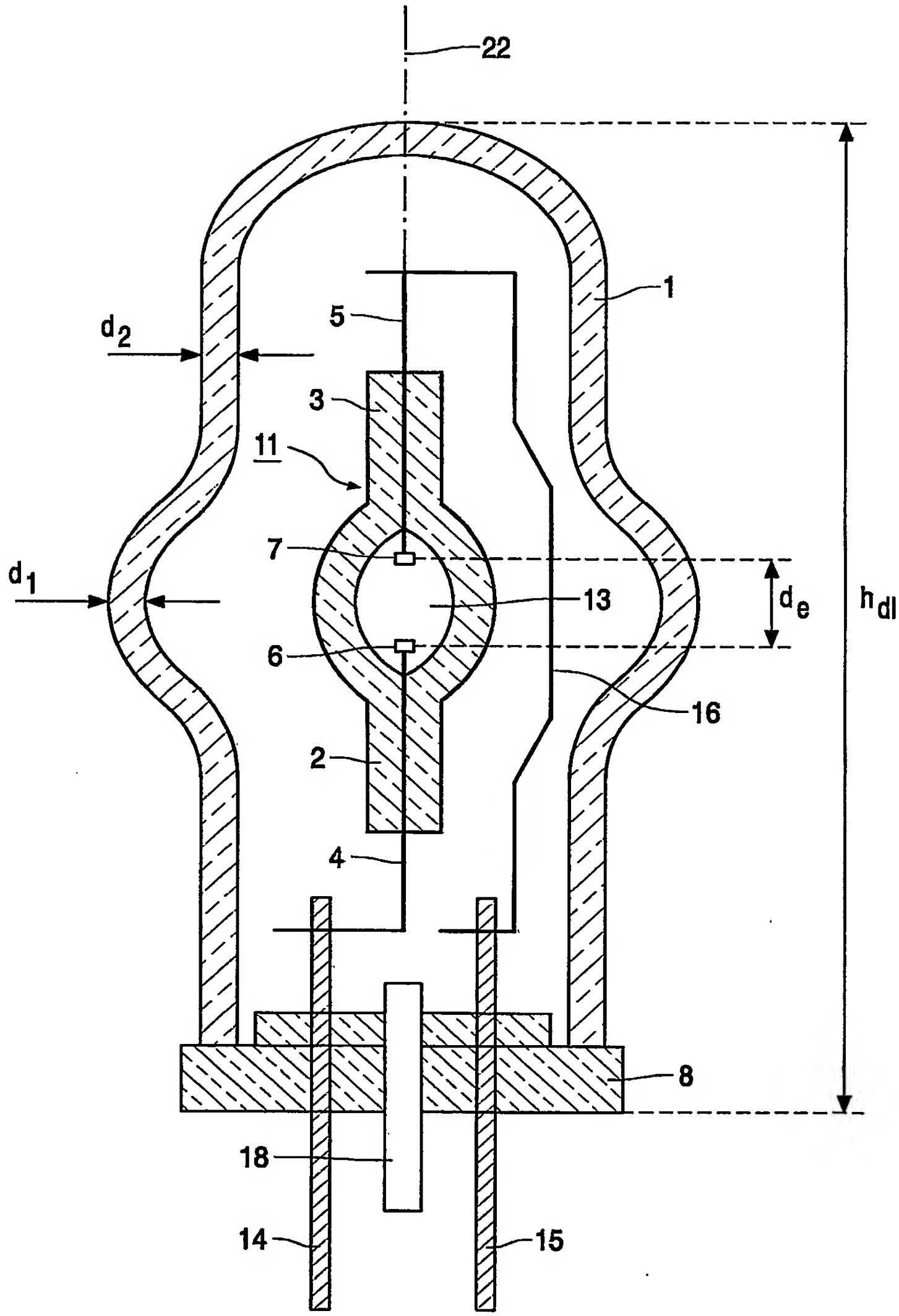

FIG. 1

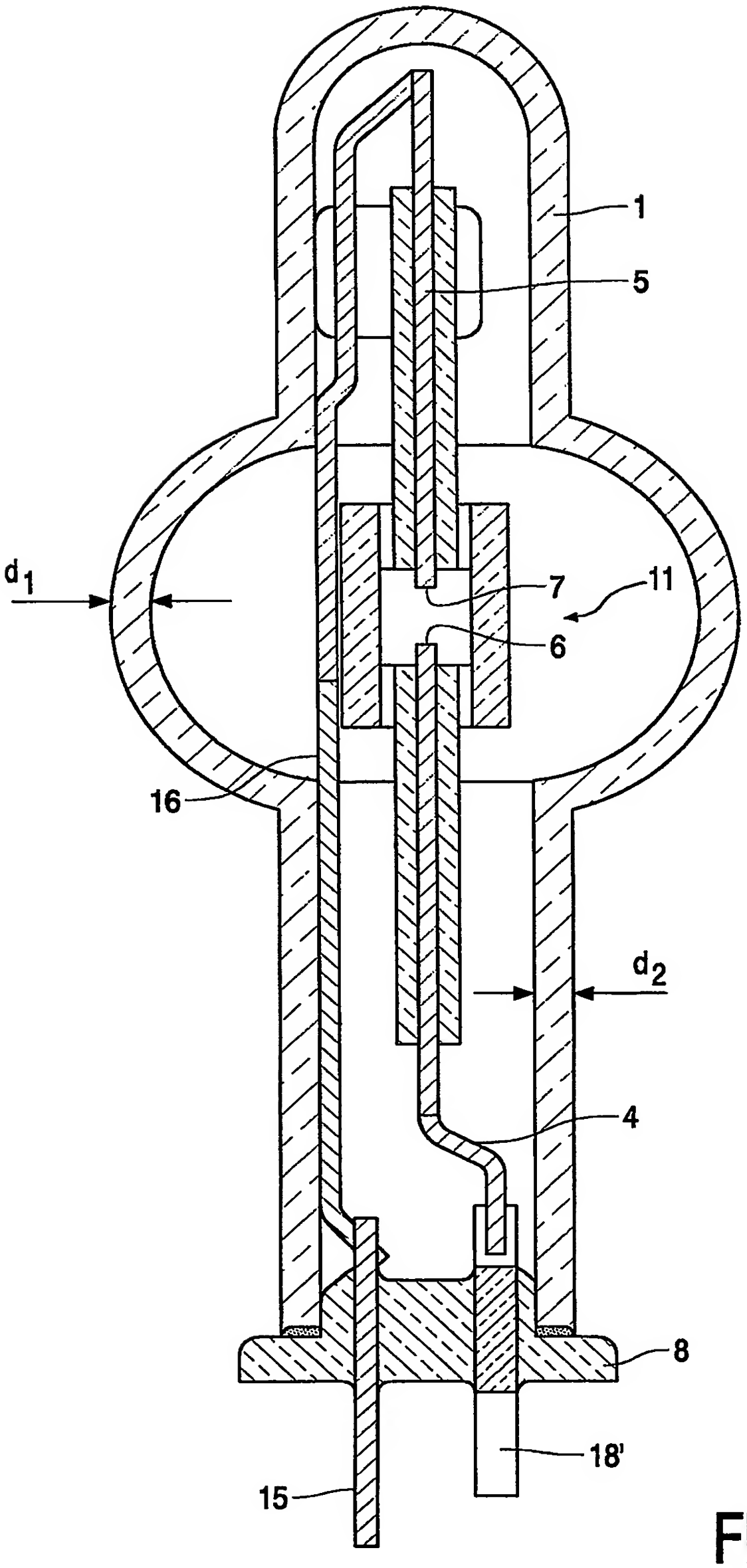

FIG. 2

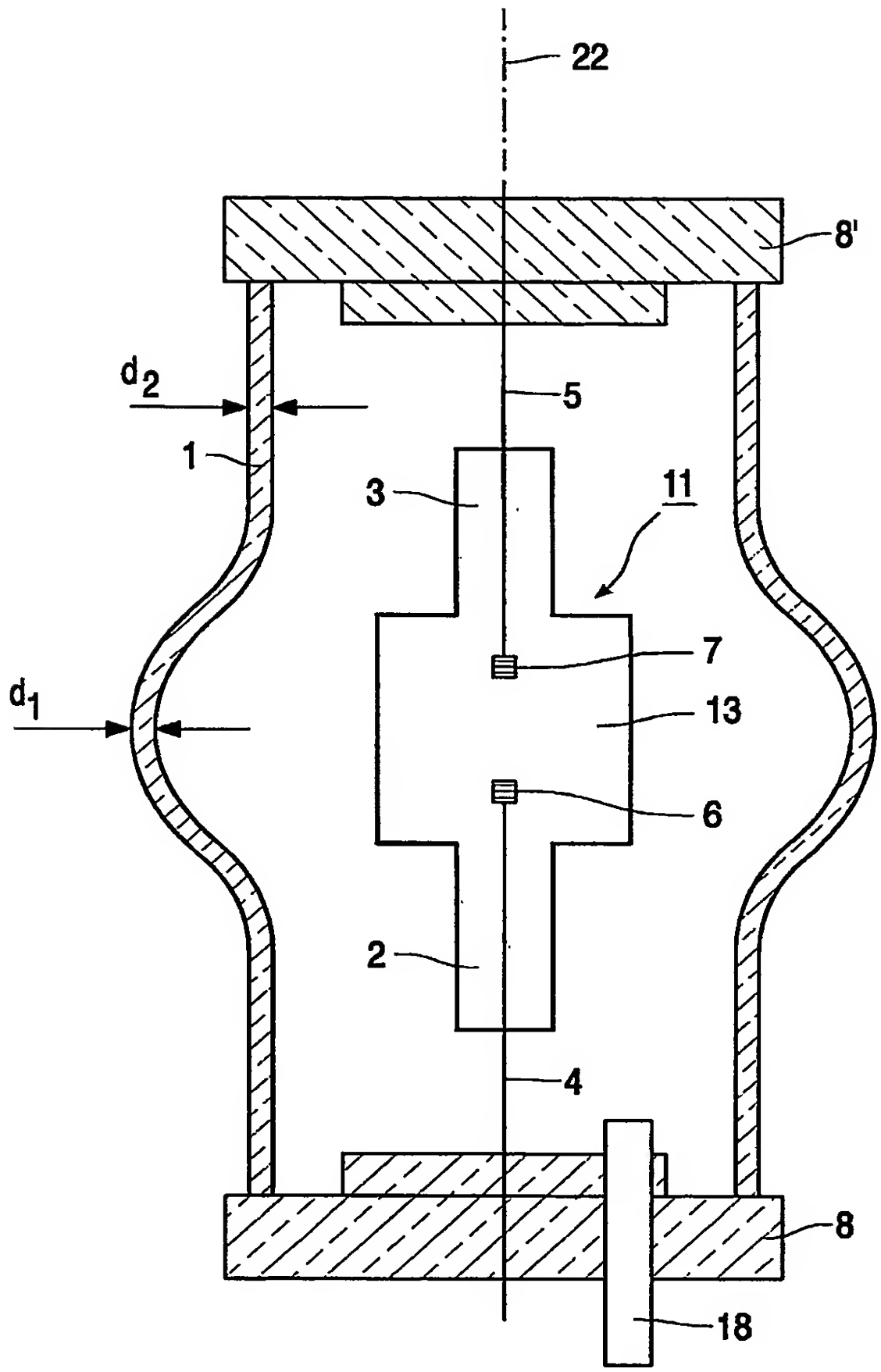

FIG. 3